Conclusions

1 The blade wake mixes out very much more rapidly than the passage wake within the vaneless diffuser.
2 At the above design flow rate the shear gradients associated with the blade and passage wakes and the secondary flows are much stronger.
3 Circumferential variations in velocity are prevented from mixing out rapidly at the higher flow rate due to the presence of the strong secondary flows.
4 The hub boundary layer is thinner than that on the shroud at the last measurement station. The ratio of the boundary layer thicknesses is around 2:1 for the below and 10:1 for the above design flow rate.
5 The optimum vaneless space for a vaned diffuser increases with flow rate, because of the slower mixing out of circumferential variations. Twisted vanes will also minimize incidence losses.
6 It is impossible to avoid significant incidence losses with fixed vane diffusers if a wide flow range is required, because of the inherent dependence of flow angle on flow rate.

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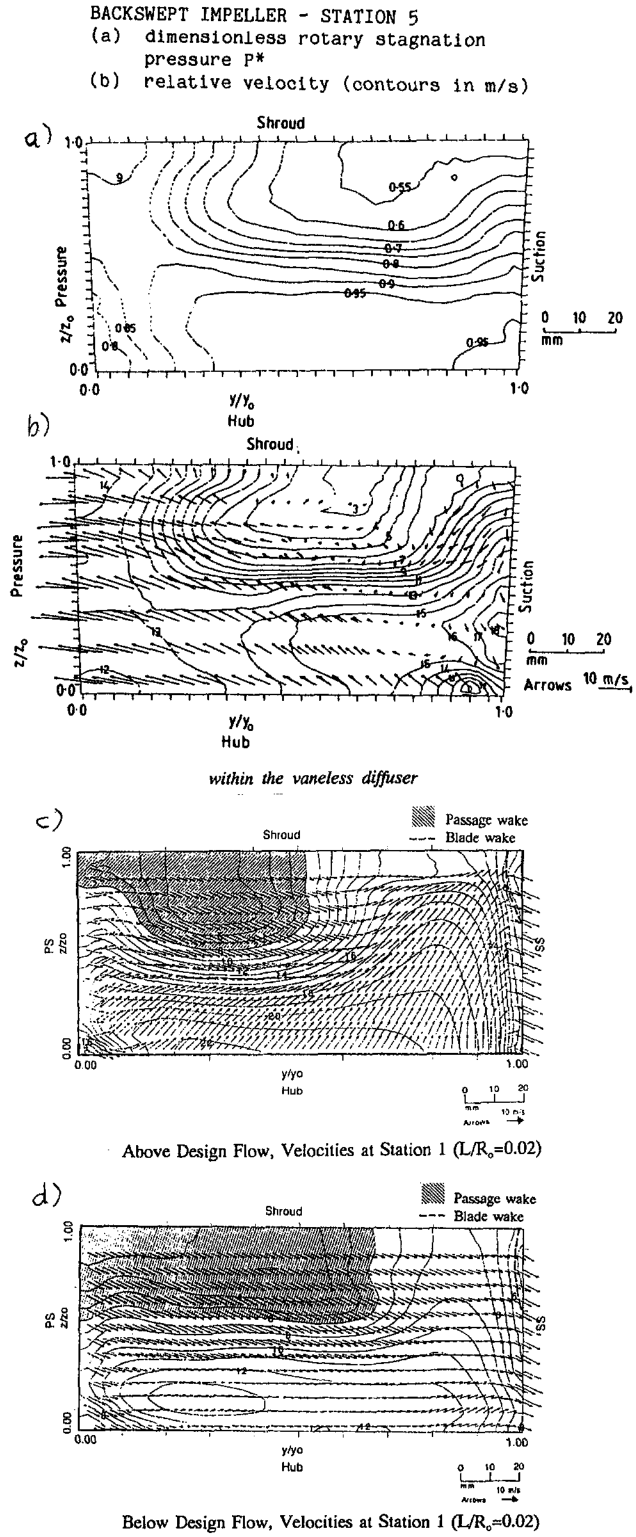

Fig. 21 Comparison of the secondary flow fields between the impeller outlet (in (*b*) at normal operating point with the corresponding dimensionless rotary stagnation pressure *p* in (*a*)), and the diffuser inlet (in (*c*) for high off-design flow at 111 percent and in (*d*) for low off-design flow at 84 percent

DISCUSSION

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I am concerned that some of the measurements in this paper are inaccurate enough to be misleading. My concern centers on the velocity vectors, shown as arrows, in some of the measuring planes. When the arrows spring from a position near a solid surface, but are inclined at a large angle to the surface, there is reason to feel that something may be wrong. This is the case near the hub wall in Figs. 3, 5, 7, 9, 11, and 13, each at a progressively greater distance from the impeller outlet. The odd-numbered figures are for flow rate greater than the design value. (The corresponding even-numbered figures, at a flow rate below that for design, do not show the arrows inclined at large angles to the wall.) I am inclined to think that the measurements at the higher flow rate were compromised in some way. Would the authors care to clarify this for us?

If the measurements represented by the arrows are inaccurate, what about the velocities represented by the contours?

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